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CHILD MORBIDITY PATTERNS AND THE RISK TO ZINC DEFICIENCY: A CASE OF ELGEYO-MARAKWET COUNTY, KENYA

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ABSTRACT
Millions of people throughout the world have inadequate levels of zinc in the diet due to limited access to zinc-rich foods and the abundance of zinc inhibitors such as phytates, common in plant-based diets. However, Zinc deficiency is a major health problem in developing countries, especially among young children. This is due to lack of intake of animal foods, high dietary phytates content, inadequate food intake and increased fecal losses during diarrhea and Kenya is no exception. This research was carried out in Kibirem Location,Tot Sub-district in Elgeyo Marakwet County, a region that is largely an Arid and semi-arid and suitable for limited agricultural production. The main objective of this study was to determine the relationship between child's morbidity patterns and the risk to zinc deficiency. The study found that the increase in morbidity patterns in children leads to increase in risk to zinc deficiency. It was also found that those children who had Zinc supplementation in their diets had shown momentous paybacks in prevention, management and treatment of diarrhea and pneumonia. The study recommends that zinc supplementation for under-five year old children in the county be enhanced.

KEYWORDS: Morbidity, risk, zinc deficiency, Nutrition, Elgeyo Marakwet County, Kenya

1. INTRODUCTION
The World Health Organization has identified zinc deficiency as a major risk to child health (WHO, 2002). Two billion people worldwide do not get enough zinc through their diets (International Zinc Association, 2011), and the abundance of zinc inhibitors, such as phytates, common in plant-based diets (Sandstead, 1991). The public health importance of inadequate zinc intakes has been hampered by a lack of indicators of zinc status for identifying individuals with zinc deficiency (Wood, 2000). Zinc deficiency weakens their immune system and leaves them vulnerable to conditions such

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as diarrhea, pneumonia and malaria. Zinc deficiency is also accountable for impairing physical and intellectual development, preventing children from reaching their full potential (International Zinc Association, 2011).

Zinc is an essential micronutrient for human health. It is vital for activating growth and physical and neurological development in infants, children and teenagers. Zinc is found in all parts of the body. It is a component in more than 300 enzymes and influences hormones. Zinc also accelerates cell division and enhances the immune system. Zinc is vital in protecting the body from illnesses and fighting infections, and it can reduce the duration and severity of a common cold or halt diarrhea (International Zinc Association,2011).

Zinc deficiency has far reaching effects particularly in children,contributing to stunted growth(Brown and Peerson, 2001), as well as morbidity from diarrhoea, pneumonia and malaria (Shankar 2000).Worldwide, it is estimated that zinc deficiency is responsible for approximately 16% of infections of the lower respiratory tract, 18% of malaria and 10% of diarrheal diseases. In 2002, about 1.4% of deaths world-wide were attributed to zinc deficiency (WFP, 2005). Zinc deficiency is largely related to inadequate intake or absorption of zinc from the diet, although excess losses of zinc during diarrhoea may also contribute (Gibson, 1994; WHO, 1996).

Evidence indicates that global estimates of zinc deficiency in pediatric or other populations are lacking. However, based on an estimated prevalence of inadequate intakes obtained from various national food supplies, the global prevalence of zinc deficiency is estimated to be 31% (range is 4%– 73%) with a high prevalence that is, 37%–62% found in southern and central African regions (Caulfield & Black, 2004). In a Jamaican study of stunted children, aged 9 to 24 months on enrolment, the number of days the children were too sick to play or run around in the following two years was related to their developmental levels on the Griffiths Test. This finding was probably an indicator of the more severe infections, as there was no relationship between the number of days with symptoms of respiratory infections and the number of days with diarrhoea. In Brazil, the number of days ill with diarrhoea in the first six months of life was related to poorer performance on the Bayley Test at 12 months of age in low-birthweight babies but not normal-birthweight babies. This later finding is another example of an interaction between two concurrent biological risk factors.

While, in Kenya zinc deficiency is 51% among children under 5 years (Kenya Micronutrient Survey, 1999). Dietary surveys are conducted in many countries, but few such surveys exist in developing countries (WHO, 1996). Even when dietary intake data are available, incomplete information on the content of zinc and its bioavailability in local foods has made calculation of zinc bioavailability problematic. In an in-depth study of Kenyan toddlers, morbidity was recorded by weekly recalls from 18 to 30 months of age, behaviour was observed at home, the Bayley Test was administered at 30 months, and a comprehensive battery of cognitive and language tests was administered at five years of age. The toddlers were sick with mild to moderate infections an average of three days a week, with girls having more illness. Girls with more illness played and vocalized less at home and had poorer cognitive skills than girls with less illness. This difference remained significant when extensive covariates and nutritional status were controlled for.

From the foregoing discussions, Zinc deficiency contributes to increased risk of incidence for important childhood diseases that are predominant causes of death among children. Direct estimation of the risk of cause-specific mortality among children due to zinc deficiency is scanty from the literature. It is hoped that the findings of this study will be useful to fill this gap. The authors argue that the findings of the study will help policy makers at county level and national government in planning for nutrition interventions to mitigate zinc deficiency.

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2. METHODOLOGY

The research adopted a cross-sectional survey in Kibirem location which has three villages: Kapsiren, Kapchesom and Kabishoi. The study target population was 3100 households in the sub-district. The study sample size was calculated using Yamane's formula (2009).

$$\text{Sample size } n = \frac{N}{1+N(e)^2}$$

Where n= sample size
N= population size
E=sampling error
^= raised to the power of

$$\text{Therefore } n = \frac{N}{1+N(e)^2}$$

$$n = \frac{3100}{1+3100(0.05*0.05)}$$

$$n = \frac{3100}{8.75}$$

Therefore, n=355

Questionairres were used to gather information about the children morbidity patterns.Qualitative and quantative techniques were used in data analysis.Responses were coded and the quantative data analyzed using the statistical package for social sciences(SPSS version 19). Descriptive statistics (frequencies and percentages) and inferential statistics (correlation) were generated and interpretations made and summarized with respect to the study objective.

3. FINDINGS AND DISCUSSIONS

Caregivers Educational Level

Education was considered a key background characteristic that could influence the child's risk to zinc deficiency. The education distribution of the respondents was analyzed in order to establish the prevailing levels of education among caregivers. This is represented in table 1.1 below:

Table 1.1: Caregivers educational level

Educational level	Frequency	Percent	Cumulative Percent
Primary	236	67.4	67.4
Secondary	70	20.0	87.4
None	44	12.6	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

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Analysis for Table 1.1 above revealed that most caregivers were illiterate having gone up to primary school (67.4%) and a few had attained above secondary school level of education (20%) leaving a the smallest percentage (12.6%) who never attended school. These findings are supported by a study by Abdalla (2009) that investigated some of the social and economic factors affecting nutritional status and feeding patterns of children under-five years that concluded that maternal education affected the children's nutritional status. Abuya (2012) also suggests that improving mother's years of school may have significant influence on the children's' nutrition status.

Caregivers Source of Income

The study was interested in investigating caregivers' sources of income. This was important in this study to show the respondent's financial ability in provision of basic needs. The results are as shown in Table 1.2 below:

Table 1.2: caregivers source of income

Caregiver Source of Income	Frequency	Percent	Cumulative Percent
Business	114	32.6	32.6
Laborer	90	25.7	58.3
Unemployed	146	41.7	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

Analysis in Table 1.2 above, noted that most of the mothers 32.6% engaged in business, 25.8% were labourers and 41.7% were unemployed. The inclusion of respondents' source of income was important since it showed the household's power in dietary diversification and food purchasing. These findings are supported by a study by Conrad (2006) who found out that income status in a family affected the nutrition status of the family members. This is because the family with a low income cannot afford a nutritious diet due to low food purchasing power.

Caregivers Marital Status

The study was interested in understanding the marital status of the respondents. The respondents' marital status was important to show the social position of the family. The findings are shown in Table 1.3 below:

Table 1.3: Caregivers Marital Status

Caregivers Marital Status	Frequency	Percent	Cumulative Percent
Married	73	20.8	20.8
Single	128	36.7	57.5
N/A	149	42.5	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

Table 1.3 show that 20.8% of the respondents were married, 42.5% did not respond on the question and hence unable to ascertain their marital status and 36.7% of the respondents were single. During a focus group discussion the study found that most of the respondents (42.5.7%) who did respond to the question were from single parent families while the rest were either married while others did not disclose their marital status. The respondents' marital status was an important indicator of the family's stability in provision of basic needs (WHO, 2006). These findings are supported in the literature

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review by (Ezzati, 2002) who found that the demographic conditions especially the marital status of a parent may play a key role in malnutrition and its eradication.

Children's Gender

Gender was important in this study since it gave an idea of how the children were distributed in terms of gender in the study. Sex of the children who were under study was sought to establish whether the number of boys and girls were equal/same. This is shown in Table 1.4 below:

Table 1.4: Children's Gender

Gender	Frequency	Percent	Cumulative Percent
Male	176	50.2	50.2
Female	174	49.8	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

Analysis form Table 1.4 above established that the number of baby boys studied was 176 (50.2%) on that of baby girls was 174(49.8%). The study findings show that the number of baby boys to that of the baby girls were almost equal.

Children's Age

Children's age was important in this study since the study focused on 1-3 year old children thus this showed the distribution of the ages for both girls and boys in the study as presented in Table 1.5 below:

Table 1.5: Age in Brackets of the Child in Years

Age brackets	Frequency	Percent	Cumulative Percent
1 year	117	33.4	33.4
2 years	116	33.1	66.6
3 years	117	33.6	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

It is evident from Table 1.5 above that 74(33.5%) of the children were 1 year old, 73(33.0%) were aged 2 years old and the remaining 74(33.5%) were aged 3 years. It was found out that age distribution among the children who participated in the study was evenly distributed. According to WHO (2006), under five year old children are at a high rate of malnutrition and it also gives emphasis on children transitioning to complementary foods as a group at risk nutritionally.

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Children's Morbidity Pattern

Response on whether the child has been ill the last two weeks. The findings revealed that most of the children who took part in the study were ill. It was established from the study that 50.2% of the children reported episodes of illness two weeks prior to the study while 49.8% did not report any illnesses.

Table 1.6: Response on children's illness

Response	Frequency	Percent	Cumulative Percent
Yes	176	50.2	50.2
No	174	49.8	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

Type of Illness on Children

Table 1.7: *Type of Illness on Children*

Type of illness	Frequency	Percent	Cumulative Percent
Cold/cough	28	8.1	8.1
Diarrhea	89	25.4	33.5
Vomiting	87	24.9	58.4
None	144	41.6	100.0
Total	**350**	**100.0**	

Source: (Field data, 2014)

It was established from the study that 8.1% of the children had cold, while 25.4% suffered diarrhea, 24.9% suffered vomiting episodes while 41.6% did not suffer any illness prior to the study. These findings concurs with (Chege, 2010) who found out that preschool children suffer from illnesses which manifested with symptoms such as diarrhoea and vomitting as a result of consumption of fewer meals per day and inadequate consumption of micronutrients.

4. CHILD'S MORBIDITY PATTERNS AND ZINC DEFICIENCY

In order to test the objective of the study, the study formulated an hypothesis, HO_1, which sought to determine the effect of child's morbidity patterns on Zinc deficiency at 0.05 level of significance. It stated:

$H0_1$. Child's morbidity patterns do not significantly affect Zinc deficiency among children 1-3 years Pearson's product moment correlation coefficient test was used to correlate the Child's morbidity patterns index and Zinc deficiency index. This was done in an effort to establish the correlation between the two variables and the strength and direction of that relationship at 0.05 level of significance. The results are presented in Table :

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Table1.8: Pearson's correlation test on the effect of child's morbidity patterns on Zinc deficiency

Risk to zinc deficiency		Zinc deficiency Index
Child's morbidity patterns Index	Pearson's Correlation	0.421**
	Sig.(2 -tailed)	.000
	N	350

** Correlation significant at the 0.01 level (2-tailed)

The results of the correlation test indicated that child's morbidity patterns positively affected Zinc deficiency (r= 0.421, p= 0.000).The null hypothesis was therefore accepted and the alternative hypothesis rejected.

5. CONCLUSION AND RECOMMENDATIONS

Zinc deficiency in children has become a major health nutritional problem. The findings of the study showed that socio-economic and socio-demographic factors play a big role in nutrient deficiencies specifically zinc deficiency. This is attributed to factors such as parents' educational status; parent's job, family size and mother's age affect the aspects of child health on issues to do with knowledge on proper nutrition. According to this study, the most frequent type of illness reported was diarrhea followed by vomiting. More than half of the children were ill the last two weeks prior to the study. The most common illness was diarrhea caused by zinc deficiency. The most at risk of zinc deficiency was the age group between 1-2 years since they are being transitioned to complementary feeding and also they are the group with the most incidences of diarrhoea and due to this they lose a lot of zinc. The morbidity patterns were also linked with poor nutritional status of the children since their resistance to infections and diseases was low. Improvement in societal infrastructure, better maternal education and knowledge about proper nutrition are needed to maintain the overall child's health. The study recommends that increasing the production and consumption of foods with a high content and bioavailability of zinc, like animal-source foods. Animal protein can also enhance the absorption of zinc (and non-heme iron). Additionally specific research is recommended to investigate the risk factors associated with recurrent episodes of diarrhea among children under 5 years in Elgeyo-Marakwet and a longitudinal research is recommended in Elgeyo-Marakwet to establish the long term effects among the variables

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